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**ECONOMIC ANALYSIS OF PRIVATE PUBLIC PARTNERSHIPS:
A CASE STUDY OF “TOLL COLLECT GMBH” IN GERMANY**

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Title Economic analysis of Private public partnerships: A case study of "Toll Collect GmbH" in Germany			
Subject Economics	Type of the degree Master of Science	Time of publication January 2020	Number of pages 64
Abstract <p>Private Public Partnerships (PPP) are getting established in an increasing rate. They are seen as perfect substitutes to traditional procurement of public goods and services, like education, health care or infrastructure. Their objective is to deliver the public goods / services to the public in higher efficiency, higher quality and contribute to the country's economic growth.</p> <p>This thesis analyses modern PPPs and why some of them tend to fail in the long run. For this thesis, failure means the PPP becomes a public company, has high transaction costs or gained a bad reputation during its operation period, because the public has to carry the main costs of the potential malfunction.</p> <p>To reach the thesis objective, the thesis is split in two main parts: the theoretical approach and the case study. The theoretical approach evaluates of PPPs on the theoretical level, the case study gives a real-life example for a PPP, the "Toll Collect GmbH" from Germany.</p> <p>During the research for both approaches, several factors and issues emerged considering the PPP-performance. These findings are the main focus in the discussion and are vital for the overall PPP-success. The research findings indicate that human misbehaviour (opportunism, etc.), internal problems between the partners (conflict of interest), the bias reliability of the available "hard data" and planning mistakes on microeconomic level are responsible for a PPP-failure. These findings are related to other issues regarding transparency, monitoring and cost handling of PPPs.</p> <p>To reduce the failure rate for the future, the thesis proposes a better governance structure with an independent audit body, CSR standards for the project partners and the higher consideration of scientific research in that field during the planning period.</p>			
Keywords Public Private Partnerships, Toll Collect GmbH, state, private sector, privatization			
Additional information			

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Foreword

This thesis is a highly inspirational source for me and meets my personal preferences. When I was proposing this topic to my supervisor, I had several other possible subjects in my mind. These might be suitable candidates for future doctoral studies.

During the studies, I noticed that I am more like a researcher and writer rather than an exam person. So, writing this paper was not a burden at any time, it was a pleasure and led to a desire to learn more about economics. This thesis is another further step to become a much better economist.

I would like to express my deep gratitude to my mother, my brother, my grandmother and the rest of my family who supported me through my master's studies. Their trust and belief in me and in my skills were a huge encouragement to pursue my dreams.

Special appreciation to Professor Marko Korhonen and Mr. Matti Koivuranta, my research supervisors, for their patient guidance, encouragement and useful critiques of this research work. Additionally, I thank the University of Oulu and the Oulu Business School, who made it possible to study in Finland.

I would also like to thank especially my friends and classmates. Their friendship and comradeship backed me up in uneasy times.

Oulu, January 2020

Kevin Dietrich

LIST OF ABBREVIATIONS

PPP.....	Public private partnership
EPC.....	Engineering, procurement and construction
O&M.....	Observations and measurement
AG.....	Aktiengesellschaft (engl. A stock market company)
GDP.....	Gross Domestic Product
CSF.....	Critical Success Factor
NPV.....	Net Present Value
GmbH.....	Gesellschaft mit beschränkter Haftung (in engl.: Ltd.)
HGV.....	Heavy Goods Vehicles
OBU.....	Onboard Unit
GPS.....	Global Positioning System
LKW.....	Lastkraftwagen (in engl. HGV)
CoE.....	Costs of Errors
CSR.....	Corporate Social Responsibility

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1. INTRODUCTION

1.1 Background of the thesis

With an increasing rate, Public private partnerships (PPPs) are developing in the economies around the world. According to their supporters, PPPs are a perfect substitute for traditional procurement of public goods and services¹ (Newman, 2017). They emerge in different public sectors like education, health care and infrastructure, sectors which have a vital influence on people's lives. Over the years, PPPs have come to be seen as an alternative way to deliver certain services to the population of a country or region. They are also viewed as a new way to do business between the public and private investors.

In Germany, PPPs have also become a part of the economic landscape and are part of any political discussion about the future model of the country's economy. However, the view of the media and the general public is that PPPs in Germany tend to fail in their current form during their operation period and have a negative consequence on the state which result in citizens having to carry the costs of the failure (Bedszent, 2018).

1.2 Thesis objective

The main thesis objective is to analyse present-day PPPs, using modern economic methods and models. This analysis aims to answer the question if the implementation of PPPs nowadays is a senseful contribution to a country's economic growth and which factors and risks are responsible for a PPP-failure. Therefore, this paper also evaluates the causes of possible failure and provide solutions to decrease the failure rate of PPPs.

¹ Public goods/service are goods or services which have two key features: non-rivalry, meaning quality does not diminish when more people using it, and non-excludability, meaning people cannot be prevented from using the good or service. For example air, water etc. (Kotchen, 2014). In case of PPPs, the focus is more on public goods/services which have an industrial background, meaning infrastructure, education, water supply etc.

To reach the main objective, this study takes different scientific literature and the case study as main sources for this thesis. An empirical research is not included in the thesis due to the time intensity of such an extensive research and the limited access to relevant information. Therefore, this paper uses the research outcomes of other researchers as a part of the theoretical approach, the case study as a basis of practical approaches. The choice of these methods has the purpose of narrowing the results to the highest possible accuracy.

There are also two sub-goals for this thesis. The first sub-goal is to give the reader an overall understanding of the idea and structure of PPPs. The second sub-goal is to represent current and previous academic works of other researchers and the outcomes of those academic works to the reader.

The aim of the thesis is to support policy makers, public representatives and investors in their decision making and provide significant information for the planning – and operation process. This outcome should achieve the reduction of PPP-failure rates, protect the interests of the stake- / shareholders, increase the probability for long-term success and lead to sustainable economic growth.

1.3 The scope of the thesis

This thesis focuses on two main factors: PPPs and the reasons for their failure.

The thesis describes failing PPPs, not successful PPPs. This decision ensures the fulfilment of the main thesis objective. Positive PPP-traits are mentioned, only for the context behind them.

Also, the thesis does not explain relevant legislation, some relevant economic factors and theoretical outcomes in detail, because it would exceed the thesis extent and the formal thesis requirements. To compensate, this thesis will describe those points in a superficial, understandable way.

Other mentionable limitations and information are noted in the footnotes.

1.4 Summary of the thesis

The thesis is split in 3 main chapters: the theory of PPPs, the case study and the discussion.

Chapter two defines a PPPs, portrays the structure, presents their main features and displays an evaluation process for their performance. This chapter should provide the reader a neutral, structural image of a PPP. Chapter three and four go deeper in the economic theory. Chapter three represents the macroeconomic theory behind PPPs. The reader find in this chapter models and the main arguments policy makers make for a PPP to the public. Chapter four presents the microeconomic theory. Here, the author describes the optimization problems of both project partners in a mathematical way and their relationship in economic terms.

Chapter five is the case study about a German PPP called “Toll Collect GmbH”. The function of this PPP is to collect tolls from all HGVs on German motorways (Toll Collect GmbH, 2019). In chapter five describes the idea, structure and the current status of this PPP and the reasons why it failed.

In chapter six, the author discusses the findings of chapter four and five to answer the question why PPPs fail in present days.

Chapter seven analyses the major issues of PPPs. These issues are equally important for the thesis topic.

Chapter eight suggests solutions in purpose to diminish the rate of PPP-failure and to increase their efficiency before and during the operation time.

2. THE NATURE OF PUBLIC PRIVATE PARTNERSHIPS

2.1 Definition and features of Public Private Partnerships

Finding a precise and final definition of what public private partnerships are, is difficult. There are a variety of ways to define PPPs. According to Hodge and Greve (2005), one possible definition is that “*PPPs are projects which generally involves the design, construction, financing and maintenance of a public good by the private sector under a long-term contract*”.² This definition has three advantages. First, it is simple, like mentioned there are a lot of different attempts to define a PPP, so there is a need to break it into the main points. Second, it gives already a hint to which factors are flowing into such a partnership. Third, it gives a clear understanding on the foundation of a PPP.

The idea behind a PPP is that the responsible agent³ transfers the responsibility of a public-owned good to a private company under a legal contract, whose conditions are negotiated before. Figure 1 shows the scope of responsibilities between public and private. So, PPPs are a collaboration of two parties. They are mostly single project-driven, so they don't cover a large variety of goods and services (Newman, 2017). For governments, PPP is seen as a new tool for managing public services, the private company sees it as a new source of revenue within a competitive market.

² For this thesis, the author sticks to this definition. There are many more definitions about PPPs but to simplify the author will use this.

³ A city, county or state

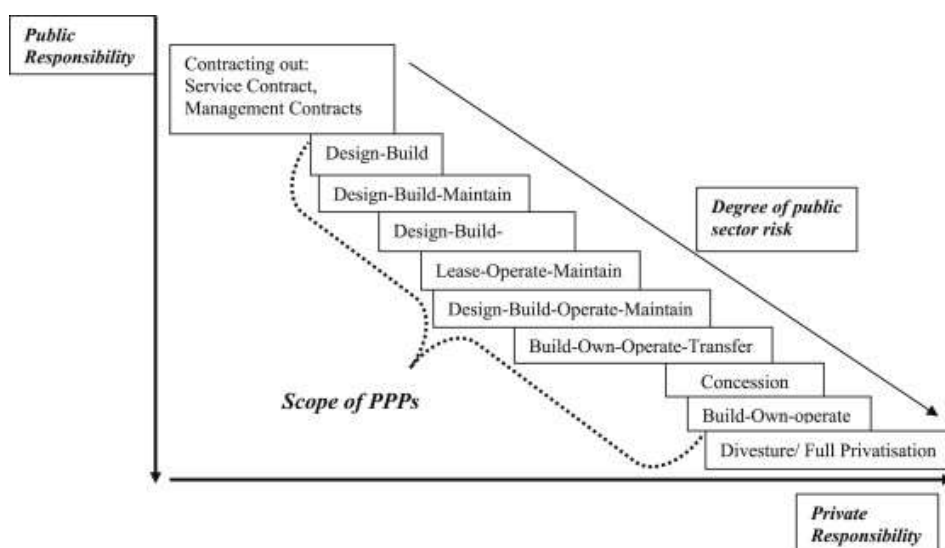


Figure 1 Scope of private and public responsibility (adapted from Roehrich, 2014)

Elisabeth Iossa (2015) characterizes PPPs in her article "*The Simple Microeconomics of PPP*" in three main features: bundling, risk transfer and long term contract.

1) *Bundling*: Iossa understands under *bundling* different kinds of modelling a partnership and to operate it. It describes which models bundles which tasks or services are contracted to a "consortium" of private firms (Iossa, 2015). For example, the DFBO-Model (design, finance, build and operate⁴).

2) *Risk Transfer*: Compared to the common ways of procurement, according to Iossa, PPPs contain a greater transfer of risk and responsibility to the private partners. The state gives basic instructions and requirements to the contractors. They convert these basic requirements into a business model which delivers the needed service to the customer. The private-sector-part hold the control and responsibility over the service but possess also the operational and constructional risk (Iossa, 2015).

3) *Long-Term Contract*: The key issue with negotiating a partnership contract is risk sharing of investment, responsibility and rewards (Newman, 2017). This key issue has a high priority in designing a contract due the fact it is binding for both factions during the operation period. The contract is the founding document of the partnership, it describes the structure, details and tasks of the project partners. Additionally, it

⁴ Those are the tasks for the private company

regulates the contribution of benefits and profits of the project among the agents. The contract stands under legal law of the respective country. This is relevant in the case of contractual disputes or potential conflicts in the future (Newman, 2017). Such contracts last around twenty to thirty-five years (Iossa, 2015).

2.2 Structure of a typical PPP

Structuring a PPP can be complex depending the results of contracting and the participating parties. A typical simple structure of a PPP is presented in Figure 2:

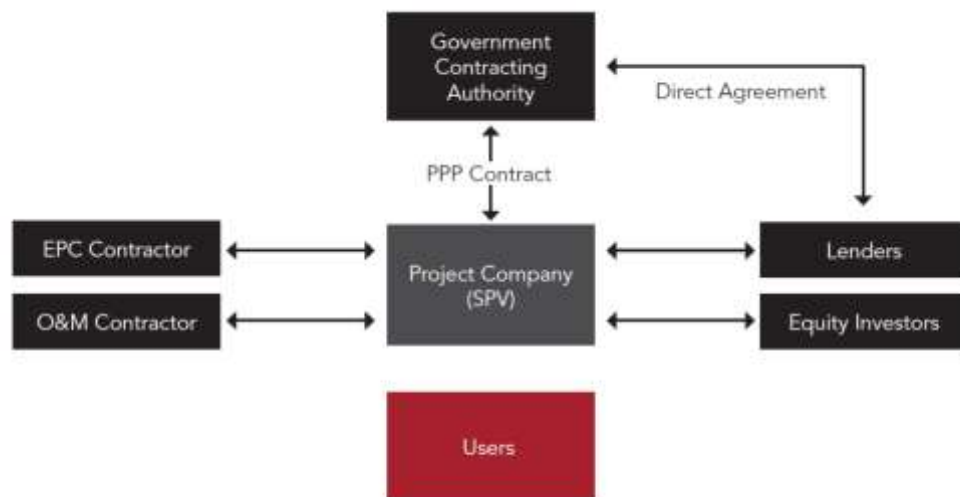


Figure 2 Typical structure of PPP (adapted from World Bank guide, 2017, p. 41)

Figure 2 shows the connections between the different bodies of the PPP. The figure can be divided in three levels: the upper part is the public sector, the level beginning with the project company is the private sector and the level with the red box is the consumption sector with all the customers. The levels gives an impression of the separation of tasks beneath the parties. Between the government and the project company, a contract is signed which builds the legal framework of the overall project.

In the private sector level, it shows which third parties, such as investors, planning companies (EPC) and lenders, are connected to the project and their relationship⁵ with the PPP company.

One additional aspect to remark is the streams of funding. Financing and revenue expectations are playing an important role in planning and constructing the project. Like every basic business model, it is necessary to observe profit and cost development to make this project successful and beneficial for all parties. The main investors of the project are called "equity shareholders" (World Bank, 2017). Lenders are banks and insurance companies, provide financial security.

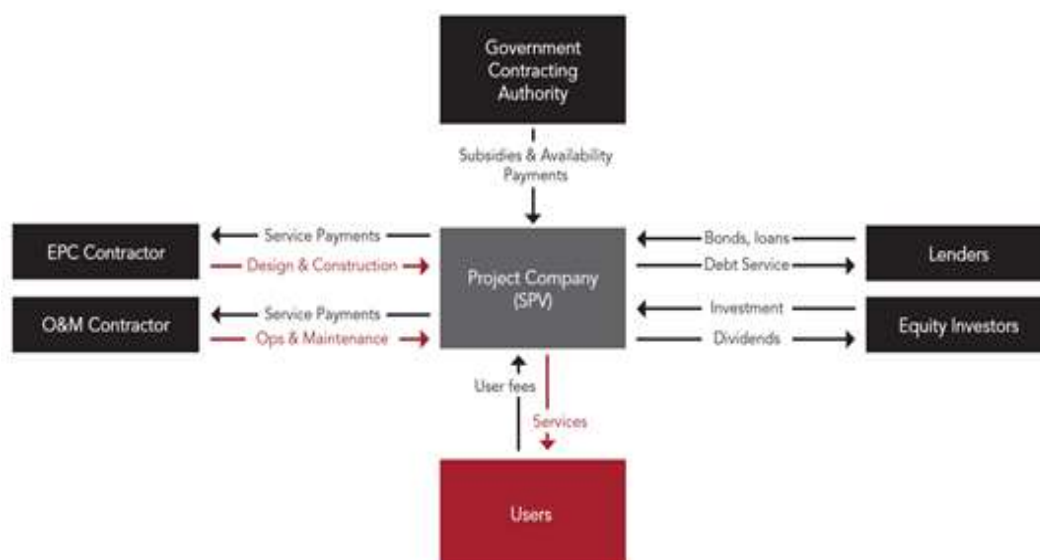


Figure 3 Flow of Funds within a PPP (adapted from World Bank guide, 2017, p. 42)

Figure 3 displays all the funding streams inside this simple PPP-model. The main sources of income is a combination of financial support by share- and stakeholders of the project and the fees from the users of the service. The main cost burdens are the delivery⁶ of the service to the users/customers and the debts to the investors and lenders.

⁵ The author will not explain the single contractors and their functions one by one, because it is not his goal for this chapter. To read more about it, the author recommends the "PPP reference guide Version 3" of the World Bank. This thesis will focus only on the economic relationship between public and private sector.

⁶ Maintenance etc.

2.3 Forms of PPPs

As mentioned, the varieties of PPPs nowadays are divers. However, there are two overall types of partnerships which differ from the contract types and their arrangements (see Appendix 1).

1) Social partnerships: social partnerships refer to arrangements in specific areas of the public sector, which affects the social life of a country's citizen. These arrangements arise in the sectors of education, childcare and healthcare. The main purpose behind these forms of PPP is to increase the capacity and efficiency of public services (World Bank, 2017).

2) Economic partnerships: The intention of economic partnership is to improve already existing industrial areas and to increase returns for all contractual partners. This happens in infrastructure projects, waste disposal and in the finance sector. These partnerships should boost economic growth and employment in those industrial sectors (World Bank, 2017).

2.3.1 Privatizations

Before PPPs became more prevalent in modern-day public planning, another form was considered to solve problems: privatizations⁷. This type is one higher level than the PPP. Privatizations means the complete transfer of responsibility and management of a service to the private sector without contractual or structural arrangements or the transformation of a former public company into a private company. The public sector is not part of any recent or future decision-making process and can control only the company via the established legislation. The motives for engaging a privatization are similar to the PPP. It promises high profit and new jobs, the public sector benefits from collecting taxes.

⁷ Privatizations are an extreme form and not exactly a PPP. This chapter should only give the reader an impression of the next possible alternative besides a PPP.

The problems with privatizations become clear when they run a service in the long-term. Those problems are numerous, and it depends on the section where the privatization is running.

The main issues⁸ with privatizations are the natural monopoly it creates, the price stability and the limited possibility to regulate it. Through handing over a specific service⁹ to a single company, the state creates a private monopoly on this service. A good example in that case is the Deutsche Bahn AG¹⁰ (Connolly, 2018). It controls all rail ways in Germany and have full market power. This prevents competition fully. Also because of monopoly, prices can fluctuate, even rise in the long-term, to cover expenditures and return expectations. The issue for the government is that it does not have any control or influence on any kinds of developments. In some cases, the government has to compensate the financial liabilities of the privatization.

Because of these disputes, there is a need for the government to keep the public interests safe against such outbursts of private mismanagement. Therefore, PPPs represent a safe substitute. The big advantage of PPPs compared to privatizations is the contractual foundation which clearly states each parties' responsibilities and limits their power. A government can now assure itself against uncertainties.

⁸ There are many more issues, here the author summarizes briefly only three, to keep focus on the actual subject.

⁹ Famous privatized industries are water supply, railways or telecommunication

¹⁰ German railway company

2.4 Performance evaluation process

Evaluating the performance of a PPP is a crucial step to evaluate the definite success of the project itself and its effect on a country's economy. There are different ways to measurement the performance, but up until 2018, these were mostly theoretical (Osborne, 2000). Campos¹¹ in 2018 developed an evaluation system, which is based on empirical researches and literature reviews about PPPs (Campos, 2018). The outcome of this review is the designation of *critical success factors* (see Appendix 2). Figure 4 summarizes the foundation for Campos' performance model based on the CSFs. To determine the relevance and weight of a CSF on the overall performance result, Campos creates a questionnaire which he contributes to several project partners. Through the questionnaire¹², the partners clarify which factors have higher priority in securing the project's success. Campos reorders the CSFs to groups ("*dimensions*"), which he also reorders in head groups ("*construct*"). Each construct contains three dimensions.

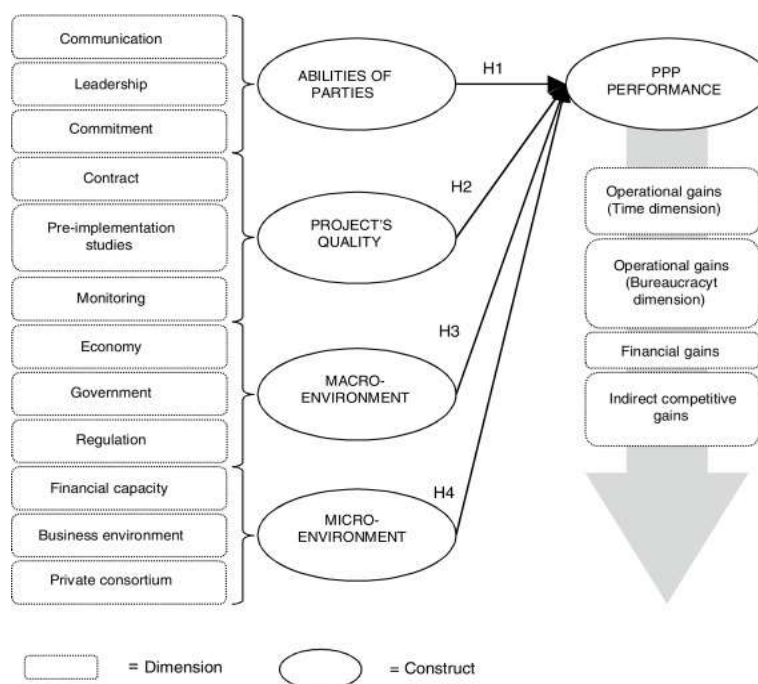


Figure 4 PPP performance model (adapted from Campos, 2018)

¹¹ The author chooses this approach of performance evaluation because its more recent and up to date.

¹² A 5-point scale ranging from "completely disagree" to "completely agree" (Campos, 2018)

According to Campos' article, the construct "*microenvironment*" shows the highest relation to the project's performance, followed by the construct "*abilities of parties*" (Campos, 2018). The construct "*macroenvironment*" is still significant to the performance but least influential as the first two constructs. This means, the project needs a form of legalisation and political support to perform (Campos, 2018). The article cannot support the hypothesis that the construct "*project's quality*" has a positive effect on the performance. This "ranking" of the construct gives insight about which sectors the parties should concentrate on, to increase performance and the gains from the project. In the end, the "performance column" sums up the total gains of the PPP, which finally measures its overall success in the target sector.

3. MACROECONOMIC THEORY OF PPPS

3.1 A brief history about PPPs

Historically, before PPPs arrived, most of the services were state-owned, strongly regulated and the private sector was supervised by the welfare state. The wave of modern PPPs occurs in the US during the 70s and 80s¹³. This was a result of the energy- and economic crises of that time (oil-crisis) and the trend of economy-friendly policies by the government under Ronald Reagan (Newman, 2017). One of the reasons to break up the common state-own welfare system was that the state budgets were not strong enough to tackle these crises and were weakened to provide the needed efficient public services. During this time, it was necessary to deliver these services to the public using alternative ways. PPPs provide such an alternative program and the government uses this opportunity *to reduce public spending and to increase private investment*. First, it was for infrastructure projects, then it shifted to the financial sector, then to other sectors of public concern. Continuing, the PPPs began to spread all over the western civilizations.

Western governments also use the tool of PPP also to boost their own efficiency among the state services through attracting professional expertise and capital from the private sector. One step was to deregulate the target sectors and change their structural and legal fundamentals. By less regulations and less state supervision, private companies feel motivated to invest and join partnerships. Another step was to open for the financial sector, which brings the needed capital into the joint ventures. All those developments were taken in the last years, with the reduction of the overregulating state and the spread of private economic expansion. This idea of economy nowadays is becoming the common sense of how western states are running their policies¹⁴.

¹³ The author found some earlier examples throughout history for PPPs. For this thesis, he limits his findings on the types of PPPs the public knows today.

¹⁴ This picture has of course its advantages and disadvantages but this is part of another discussion

3.2 Basic assumptions

As noticed from the historical development of PPPs, there are two basic motives for countries in forming such partnerships. Firstly, countries want to increase private investment and second, they want to reduce public spending. In the formula of the expenditure approach¹⁵, the effect of PPPs would result in this:

$$Y \uparrow = C + I \uparrow + G \downarrow + N \quad \text{or} \quad I > G \quad (1)$$

Where $Y = \text{GDP}$

$C = \text{Consumption}$

$I = \text{Investment}$

$G = \text{Government spending}$

$N = \text{trade deficit (N = export – import)}$

The expenditure approach (see equation 1) assumes that with the two basic motives, PPPs would have a positive effect on GDP. To mention in this case, is that the private investments must balance or even outline the loss of government spending, to obtain this positive effect on GDP. Another option would be an increasing consumption of the service by the users.

There are more motives for states to determine in a PPP-scenario, which are not represent in the expenditure approach. These are the interest in increasing employment and raising capital. These two factors occur when there is an increase of private investment in this sector. The factors and their influence on national product Y can be solved by a Cobb-Douglas aggregate production function. This function plays a fundamental role in Solows Growth model (La Grandville, 2009):

¹⁵ The expenditure approach is a common tool to summarize the Gross Domestic Product (GDP)

$$Y_t = zF(K_t, L_t) \quad (2)$$

Where Y = net output (also GDP)

t = specific time period

z = factor multiplier for inputs¹⁶

F = short cut for “Function of”

K = capital

L = labour

Rewritten the aggregate production function is:

$$Y_t = A \cdot K_t^\alpha \cdot L_t^{1-\alpha} \quad (3)$$

Where A = technology

α = production elasticities

This aggregate production function (see equation 2) states that growth¹⁷ depends on the sum of capital and labour at time t by the factor of z . Equation 3 replaces z with A , means that capital and labour are affected by the current level of technology (La Grandville, 2009). Without the factor A , sustainable long-run growth is not achievable only with capital or labour¹⁸. The Greek letter α stands for the production elasticities, mention $\alpha < 1$. According to the previous statement and to this model, PPPs contributing more capital and labour to an economy which have a positive effect on GDP, but there is the need for a continuing technical process¹⁹(La Grandville, 2009).

¹⁶ Multiplier z implies a homogenous function, which mean $zF(t) (K(t), L(t)) = F(t) (zK(t), zL(t))$

¹⁷ Growth means the growing augmentation of production and capacities within an economy

¹⁸ To learn more about the Solow Grow Model, the author recommends reading La Grandville / Solows “*Economic growth: A unified approach*”

¹⁹ A similar approach are made by E. F. Buffie with his article “*Macroeconomic dimensions of public-private partnerships*” where he uses a dynamic general equilibrium model.

3.3 Economic models for a PPP-scenario

Models display the theory of economic statements and principles. They should give the reader a compromised, simplified view on certain economic realities and behaviours²⁰. Modelling PPPs is difficult, because of the many factors to consider. Especially, if they should represent their effect on economy. First, this attempt of modelling PPPs builds on the basic assumptions and the promises of economic outcomes for the participants.

For the expenditure approach, we can assume that an increasing private investment (where $I > G$) leads to enough capital to run the project and insure good project performance. Good project performance is the main aspect for a state to support a PPP, because the state wants to generate income, which directs to a positive, steadily growing GDP (La Grandville, 2009).

Figure 5 shows the effects of PPPs from Solow's point of view, written in equation 2:

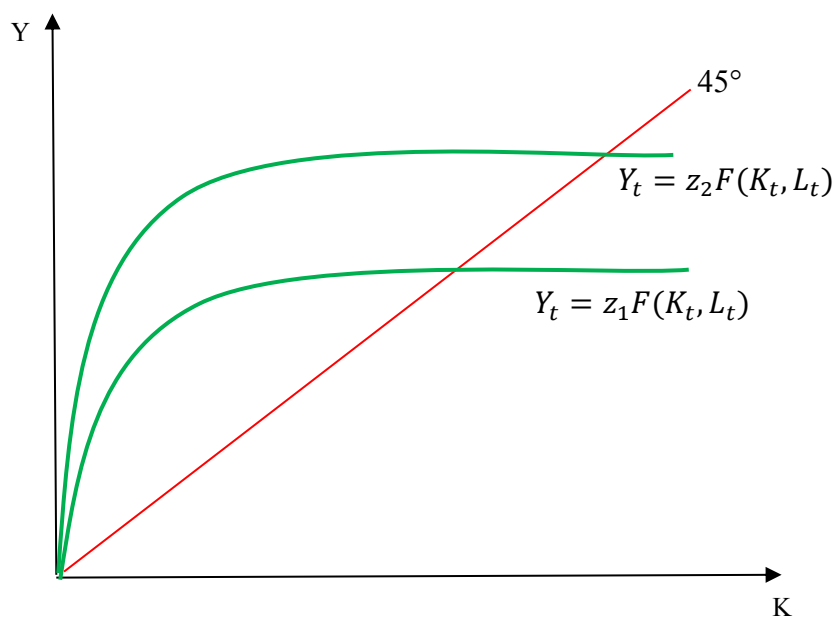


Figure 5 Solows growth model for PPPs (own adaption)

²⁰ A famous model in that case is the supply and demand-model.

As we can read from this Solow-Growth-Model, with increasing capital K , growth Y will return to a constant base in the long run. Long-run growth is only reachable with the variety of other inputs z , for example technology etc. For PPPs, that would mean if the project partners want to have sustainable growing benefits from the project, they need to expand their services, managerial skills and expertise (La Grandville, 2009).

4. MICROECONOMIC THEORY OF PPPS

4.1 The optimization problems within a PPP

This chapter provides a better understanding about the planning procedure of such a PPP on the theoretical level, there is a need for mathematical formulations to display the optimization problems, the state and the investor have before the project start, to identify their interests. Lavlinskii's article "Comparison of Models of Planning Public Private Partnerships" gives such mathematical formulas which represents the objectives of the players (Lavlinskii et al, 2016). It is important to note that, Lavlinskii assumes that both players choose rationally their best options.

4.1.1 Basic assumptions and notations

Following notations are:

- T is the set of time periods
- O is the set of industrial projects provided by the investor. He chooses the configuration of this projects depending on the state requirements (Lavlinskii et al, 2016).
- J is the set of infrastructural projects provided from the state. The state chooses specific projects with long term prospects based on their estimated efficiency (Lavlinskii et al, 2016).
- E is the set of environmental projects which are need to compensate eventual negative externalities of the projects (Lavlinskii et al, 2016).
- Infrastructural project i in time t is described as cash flow MF_{ot} ²¹ (differences between revenue and expenditures; MF = Money Flow / cash flow), cost estimation for environmental losses EL_{ot} (EL = Environmental Losses), the budget income BI_{ot} (BI = Budget Income) and the salary expectation of the population S_{ot} (S = Salaries / wages) when the project's starts (Lavlinskii et al, 2016).

²¹ The author has to change the different signs and letters of certain equations to meet the thesis requirements. The change does not affect the result nor the outcome of the optimization problems

- Infrastructural projects j in time t is described as investment costs IN_{jt} (IN = Investments), again the cost estimation for environmental loss EL_{jt} , the non-project budget revenues BI_{jt} and the paid salary in time t S_{jt} (Lavlinskii et al, 2016).
- The environmental projects e is described as project costs EE_{et} (EE = Expenditure for Environment), environmental income ER_{et} (ER = Environmental Revenue) and salaries SE_{et} (SE = Salaries for Environment) (Lavlinskii et al, 2016).
- Matrices μ and ν stand for the interconnection of the projects. Note the technological connectivity indicator of industrial / infrastructural projects is μ_{ot} , which is 1 when an infrastructure project requires an industrial project, otherwise 0. The connectivity indicator ν_{oep} defines that when there is a need for an environmental project after the implementation of industrial project, which is equal 1 when it is required, otherwise 0 (Lavlinskii et al, 2016).
- Matrices Θ and θ represent the discounts for the state and investor, related to their budgets B_t (budget state) and b_t (budget investor) (Lavlinskii et al, 2016).
- Specific partnership mechanism are described with following variables: $x_j = 1$ if the state runs a infrastructure project j , otherwise $x_j = 0$; $w_e = 1$ if the state runs an environmental project, otherwise $w_e = 0$; $q_o = 1$ and $u_e = 1$ if the investor runs the o th industrial and the e th environmental projects, otherwise 0 (Lavlinskii et al, 2016).
- In case of a PPP cooperation, the state will take over eventually some of the environmental projects from his private partner. The investor must maintain data about the value of the environmental help. The variable $\hat{w}_e = 1$ if the state takes control over the environmental projects from his investor partner, otherwise 0 (Lavlinskii et al, 2016).

4.1.2 The state's problem

The interests of the state's and its population is to maximize their net present value (NPV) from this PPP²². For the state, the costs of the PPP should not exceed the given budget (Lavlinskii et al, 2016)²³.

$$\begin{aligned} \max_{x,w,\hat{w},q,u} \rightarrow & \sum_{t \in T} (\sum_{o \in O} (BI_{ot} + S_{ot} - EL_{ot}) q_o + \sum_{j \in J} (BI_{jt} + S_{jt} - EL_{jt} - \\ & IN_{jt}) x_j + \sum_{e \in E} (ER_{et} + SE_{et} - EE_{et}) w_e + \sum_{ep \in E} (ER_{et} + S_{et}) u_{ep}) / (1 + \\ & \theta)^t \end{aligned} \quad (4)$$

With respect to the constraints:

$$\sum_{j \in J} IN_{jt} x_j + \sum_{ep \in EP} EE_{ept} \hat{w}_{ep} \leq B_t, \quad t \in T \quad (5)$$

$$(w, q, u) \in \dot{F}(x, \hat{w}) \quad (6)$$

$$x_j, \hat{w}_{ep} \in \{0,1\} \quad (7)$$

Function (4) represents the maximization of the state's NPV, in respect to the costs of the implementation of the chosen projects, restricted by the state's budget (5). The first term of (4) states the budget income of the state of the program the investor chose and the income of the population in form of wages, reduced by the environmental losses. The second term represents additional budget income and additional income of the population from an implemented program related to its expenses and environmental losses. In the third term, all environment projects are groups with their incomes, the wages for the population, the costs and expenses of the state for aiding the investor. All terms are divided by the discount for the state at the specific time t . Constraint (6) takes the optimal investor decision in account, if the state chooses to help the investor with an environmental project²⁴ (Lavlinskii et al, 2016). Constraint (7) implies that

²² Which is assumedly the quality of the service and the overall welfare (social net gains)

²³ The following model is a so called "bi-level model". It is a model where one optimization problem contains another optimization problem as a constraint (Sinhar et al, 2017).

²⁴ For example cost sharing, fundings, profit maximization etc.

variables x and \hat{w} are a choice between value 0 and value 1. The set of $\hat{F}(x, \hat{w})$ contains the optimal solution for the investor.

4.1.3 The investor's problem

To define the investor's problem, there is the relevant assumption that variables x and \hat{w} equal 1, means the state seeks a cooperation with an investor, including his interest in the optimal solution²⁵.

$$\max_{q,u} \rightarrow \sum_{t \in T} (\sum_{o \in O} MF_{ot} q_o - \sum_{ep \in EP} EE_{ept} u_{ep}) / (1 + \theta)^t \quad (8)$$

With constraints:

$$x_j \geq \mu_{oj} q_o, \quad o \in O, \quad j \in J \quad (9)$$

$$w_e + u_e \leq 1, \quad e \in E \quad (10)$$

$$w_e + u_e \geq v_{oe} q_o, \quad o \in O, \quad e \in E \quad (11)$$

$$q_o \geq v_{oe} (w_{ep} + u_{ep}), \quad o \in O, \quad e \in E \quad (12)$$

$$w_e \leq \hat{w}_e, \quad e \in E \quad (13)$$

$$\sum_{e \in E} EE_{et} u_e - \sum_{o \in O} MF_{ot} q_o \leq b_t, \quad t \in T \quad (14)$$

$$\begin{aligned} & \sum_{t \in T} (\sum_{o \in O} (S_{ot} - EL_{ot}) q_o + \sum_{j \in J} (S_{jt} - EL_{jt}) x_j + \\ & \sum_{e \in E} (ER_{et} + SE_{et}) (w_e + u_e)) / (1 + \theta)^t \geq 0 \end{aligned} \quad (15)$$

$$\sum_{t \in T} (\sum_{o \in O} MF_{ot} q_o - \sum_{e \in E} EE_{et} u_e) / (1 + \theta)^t \geq 0 \quad (16)$$

$$w_e, q_o, u_e \in \{0,1\}, \quad o \in O, \quad e \in E \quad (17)$$

²⁵ The following optimization problem is a “one-level model”

In this optimization problem, the investor wants to maximize his NPV²⁶ (8) in respect to his budget constraint (14) and the interests of the users/citizens (15) (Lavlinskii et al, 2016). Constraints (9) and (11) balancing the connection between the industrial, infrastructural and environmental projects. Constraints (10) shows choice of environmental project whether started by the state or the investor (Lavlinskii et al, 2016), taking the state's quota (13) and the requirement of implementation of a production project (12) in account (Lavlinskii et al, 2016). Constraints 16 is a target function, meaning the result should be higher than 0 or equal 0. Constraints 17 states that the variables have either the value 0 or 1.

4.1.4 Analysis of the optimization problems

In the optimization problem of the state, constraints (1)-(4), rely on the cooperation with an investor and his choice on the optimal solution. This means the investor chooses the optimal solution for the state also. The state plans the implementation of an infrastructural project only when the state has a long-term payoff of his investments (Lavlinskii et al, 2016). Consequently, the investor is planning on long-term arrangements to meet the state's interests (Lavlinskii et al, 2016), trying to avoid potential losses in reputation. Here, the investor has to align his prior interest with the interests of the public and the state. The final outcome of this model is the development program for the region, considering the different kinds of projects and a cost sharing mechanism between the state and the private investor (Lavlinskii et al, 2016). There is a chance that the state can simplify his optimization problem if he gain access and control over the resources of the investor.

Throughout the tests and based on the results, Lavlinskii (2016) argues that the state actually prefers a one-level optimization rather than the bi-level optimization. In the one-level model, the state and the investor can interact on the traditional range, bearing in mind the interest of population. In this interaction, Lavliinski (2016) states that the state should play the leading role in the cooperation, because the state need to make the decision in consideration of his budgetary constraints and the effectiveness of the project. To decrease negative effects on the environment, the reduction of

²⁶ Assumingly to maximize his profit pools and other financial gains

infrastructural constructions and more environmental projects are needed, which leads to a lowest possible profit margin for the investor (Lavlinskii et al, 2016). On contrary, the investor prefers the bi-level optimization. The bi-level model provides advantages for the investor, where he can generate more value. The reason for this is that in a bi-level model, the value of the objective function does not depend on the state's discount and stays constant when technologies are used which can influence the environment (Lavlinskii et al, 2016).

As a conclusion, Lavlinskii (2016) declares, after analysing the mathematical results of his study, that his described bi-level model is more suitable for finding compromises and ensures the long-term interest of all project partners. It can be used as a strategic instrument for planning PPPs and as a support tool for the decision-making process (Lavlinskii et al, 2016).

4.2 Game theory & PPPs

A suitable model for analysing the inner struggles of a PPP theoretically is “Game Theory”. According to Ping Ho’s article “Game theory and PPP” from 2013, Game theory can be defined as “*conflict analysis*” or “*interactive decision theory*”. Especially in PPPs, strategic decisions and interactions between the governments and its private partners playing a vital role for the performance of the project. To display the many issues and challenges²⁷ the two players face, Game Theory provides a proper analytical framework to study the dynamics of each player’s strategy and provide solutions for those problems (Ping Ho, 2013)²⁸. These frameworks could help that policy makers and private investors better coordinate with each other, to gain higher efficiency and effectiveness (Ping Ho, 2013).

In his article from 2013, Ping Ho identifies two major crucial points in his research about PPPs: the unbalanced profit structure problem and the renegotiation/hold up problem. The two problems lead to an increase of transaction costs, which have a critical impact on PPP’s suitability as a proper alternative for a public project and its sustainability for the long run, especially when the governments are inexperienced and without any professional expertise. These transaction costs are related to moral/transactional hazards and inefficiency (Ping Ho, 2013). An unbalanced profit structure occurs, for example, when the original investors²⁹ control the whole or a high amount of the procurement value³⁰, but contributed only a small amount of capital to the procurement’s equity. So, the investors are in the position to compensate their investments in a short time, receiving financial gains easier and let the stakeholder pay for the potential losses of the project. Based on the assumption of the opportunistic behaviour of the players, the investor tries to get this favourable opportunity in an aggressive way. Also, an asymmetry of information between the state and investors can also lead to an unbalanced profit structure, if the investor gets access to relevant

²⁷ Opportunism, competitive behavior, negotiations etc. (Ping Ho, 2013)

²⁸ The author will not present the full extent of Ping Ho’s work, because it would exceed the scope of the thesis. Therefore, the author reviews the most relevant points of Ping Ho’s article in this chapter.

²⁹ Ping Ho is defining them in his article as promoters

³⁰ Here the value of the PPP itself

information before the state, he can use it for his own benefit³¹ (Ping Ho, 2013). The renegotiation/hold up problem can cause high additional costs for the state. After signing the contract, the state must “hold up” granted subsidies and bear for potential debts of the project. Therefore, when a project fails, the state has to pay the subsidies plus an additional amount to cover environmental and operational costs³², to avoid a possible insolvency. The state is forced to renegotiate the contract, which is, in some cases, not desired for the public, considering political and economic impacts (Ping Ho, 2013).

To diminish inefficiency in PPPs, Ping Ho (2013) proposes two approaches. The first approach is the search for long-term profit-oriented investors for the project. The second approach is the proposal of monitoring strategies to demotivate opportunistic, short-term profit-oriented players in joining the project. These approaches are limited by the different pace of both players to adjust to the proposed strategies³³ (Ping Ho, 2013).

In the end of his article (2013), Ping Ho makes two conclusions. First, with a clear contingency framework, considering many relevant factors, the state is able to avoid the implementation of PPP, achieving high efficiency and project success. Secondly, he states when PPPs are implemented in the right projects, long-term profit-oriented investors are more suitable partners than short-term profit-oriented investors, because they have a higher motivation and higher interest on a successful running project (Ping Ho, 2013).

³¹ There are many more different factors which play a role in these problems, the author tries to cover the most relevant points. For more information, the author recommends Ping Ho's article.

³² caused by delays or other operational failures

³³ Ping Ho argues, that the state has a slow learning curve and the private investors have a fast learning curve, towards equilibrium.

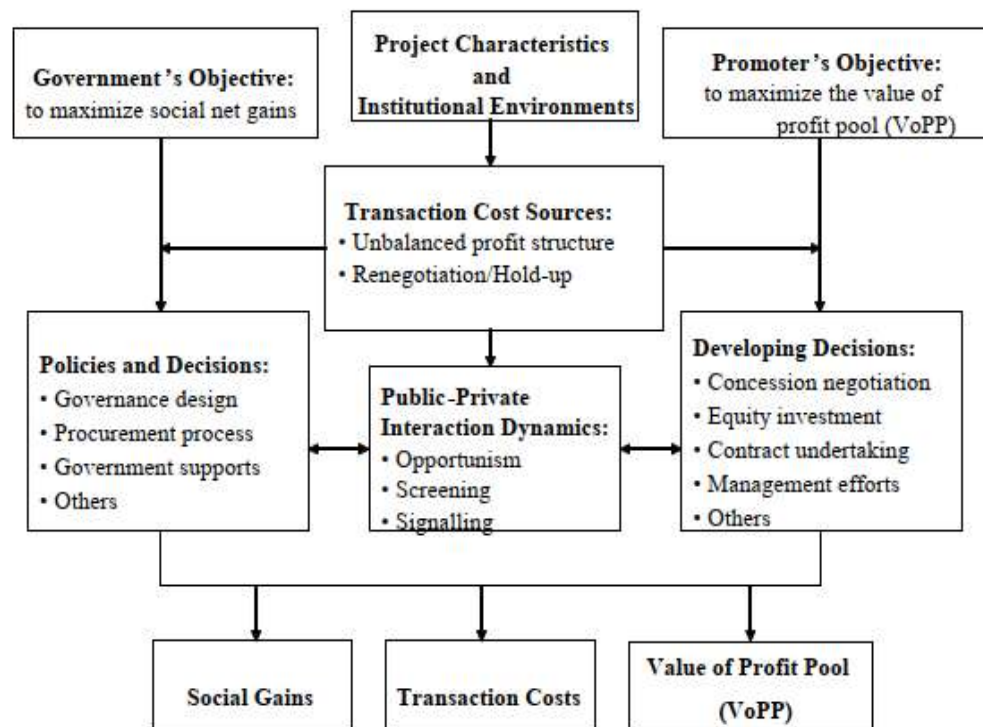


Figure 6 Interaction scheme of a PPP-Process (adapted from Ping Ho, 2013)

Figure 6 displays the different interactions within a PPP, defined by Ping Ho. It represents the motives, strategies, the player's attitude and their different contributions which they bring into the PPP.

5. CASE STUDY “TOLL COLLECT GMBH”

5.1 Economic relevance of HGV transportations on motorways in Germany

Because of its geological location in the centre of Europe, Germany is a so called “transit-country”. This means for the goods transport³⁴ and the international trade between East and West Europe, Germany plays a vital role with its infrastructure and roads. In the last decade, goods transportation in Germany has increased steadily since today (Destatis³⁵, 2019). Millions of tonnes are carried in Germany, primarily on German motorways and highways (Destatis, 2019). Transport via HGVs makes up the biggest share of transportation of goods, far more than rail- and waterways, between 1997 till 2015 it grows by 70 percent to 83 percent (Broaddus & Gertz, 2008). The statistics proves the economic relevance and value of truck transportation in Germany. To compensate for the steady growth of transportation, the German federal government is planning with a growing demand for financial resources for maintenance and repair of its motorways³⁶. Figure 7 displays the increase in federal investments in traffic from 2010 till 2018.

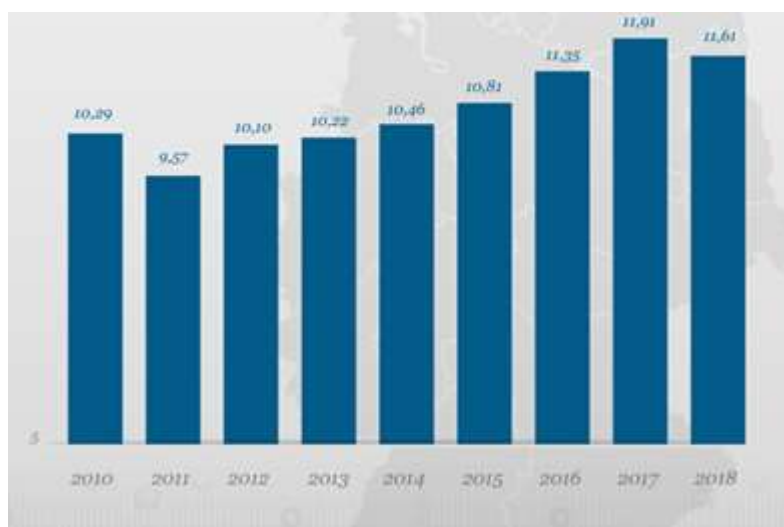


Figure 7 Federal investments for infrastructure from 2010 till 2018, in billions (Adapted from the Federal Department of Finance, 2019)

³⁴ motorways, railways, waterways

³⁵ German Bureau of statistics.

³⁶ For maintenance and repair

As the Figure 8 shows, since the beginning of the 2000s, goods transport surpasses the passenger transport, with a small drop at 2008 due to the economic crisis between 2008 and 2010. Also, this graph shows the rising importance of transportation for the transit-country of Germany. Note that Germany, with around eighty million people, is the most populated country of the European Union. This means that transported goods have a higher travel ratio than the population. This is another indicator of the economic relevance of good transportation and the transportation industry in particular.

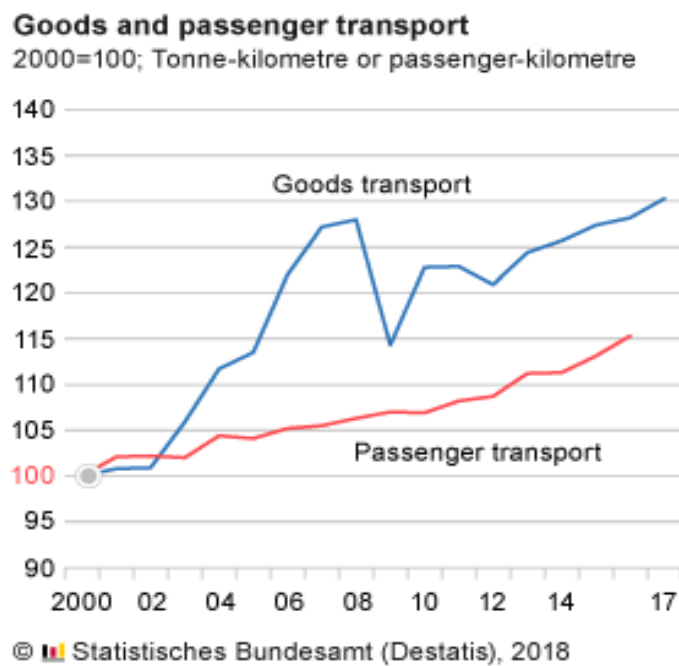


Figure 8 Goods and passenger transport (adapted from Destatis, 2018)

5.2 History of “Toll Collect GmbH”

5.2.1 Reasons

The plan to introduce this kind of PPP to the public is based on several motivations and goals of the federal government of Germany³⁷. The reason³⁸ for the former government’s decision to start planning for a PPP is that they were partly prejudiced privatizing completely the toll system in favour of the private sector and were afraid of negative public relations.

1) *Rising trade*: With the rise of trade, the transportation of goods also rose, especially on roads. With the fall of the DDR³⁹ and with the ongoing extension of the European Union, Germany and its infrastructure became the focus of the internal European trade. The need for infrastructure is simultaneously growing with the traffic of trade. Therefore, public investments in road network are also growing (Broaddus & Gertz, 2008). The domestic companies didn’t fight that toll system because their competitors have to pay the same fees and they received subsidies from the government.

2) *Creation of new financial sources*: As already mentioned in subchapter 3.1, states often use PPPs to replace the traditional public procurement, which is often seen as “old-fashioned” and obsolete, with new ways of financial procurement. New capital sources of user fees⁴⁰ and private investments should exist besides the taxes on gas and fuel, to minimize and cover public expenditures.

3) *Optimization of efficiency*: Considering research papers and news articles, one of the major arguments for Toll Collect is that this PPP is more efficient than under traditional public management and to encourage new business operations which are beyond the public sector (Broaddus & Gertz, 2008). The PPP should bind private and public competences in the traffic sector and become so more profitable for the state.

³⁷ For this subchapter writes only about the planning and construction of the PPP. Critics to the PPP are written in subchapter 5.3 and chapter 6 “Discussion”.

³⁸ Many of the reasons which are described in this subchapter are similar to the mentions in subchapter 3.1

³⁹ Deutsche Demokratische Republik (Democratic People’s Republic of Germany)

⁴⁰ Includes fees from foreign HGVs

4) *Outsource responsibilities*: A vital point in creating such a PPP for a state is outsourcing managerial responsibilities from the public sector to the private sector. Especially the transfer of the task of maintenance of the toll system and its internal processes, to reduce possible costs for the public. The state still a fair share of the collecting tolls, but the complete supervision of the project was in the hand of the PPP-company.

5) *Environmental concerns*: With growing trade there is also growing output of CO₂-emissions. In times where climate change plays a major part in political discussions and where the debate is on whether states should ban certain types of vehicles to reach climate goals, tolls can be one solution to diminish CO₂ pollution. The struggle here is how to price the CO₂ output of HGVs without having a negative effect of the economy. Additional, subsidies were payed to companies, when they purchase cleaner and environmentally friendly HGV (Broaddus & Gertz, 2008).

5.2.2 Structure & functionality of Toll collect

The structure of Toll collect in Figure 9 is close to the model in Figure 2. The public sector is represented by the federal ministry of transport and traffic, the private sector with its three main lenders, the PPP-company Toll Collect GmbH and the users. The main actors of the private sector, also called “private consortium” are the German Telekom Deutschland AG⁴¹, Daimler Financial Services AG⁴² and the French company Cofiroute⁴³. Those three companies are responsible for the funding of the project and receive in return the dividends, divided in 45:45:10 share (see Figure 10). The PPP manages the system process of the project, handles the accounting and collect the tolls from the users per year, which are flowing from the PPP to a trust account, then to the German state treasury (Broaddus & Gertz, 2008). For that, state covers the cost of the PPP (Broaddus & Gertz, 2008), measuring yearly incomes of around 650 million euros (Broaddus & Gertz, 2008).

⁴¹ Germany’s biggest telecommunication company

⁴² A subsidiary of one of the major German car manufacturers

⁴³ A construction company, part of the Vinci Group

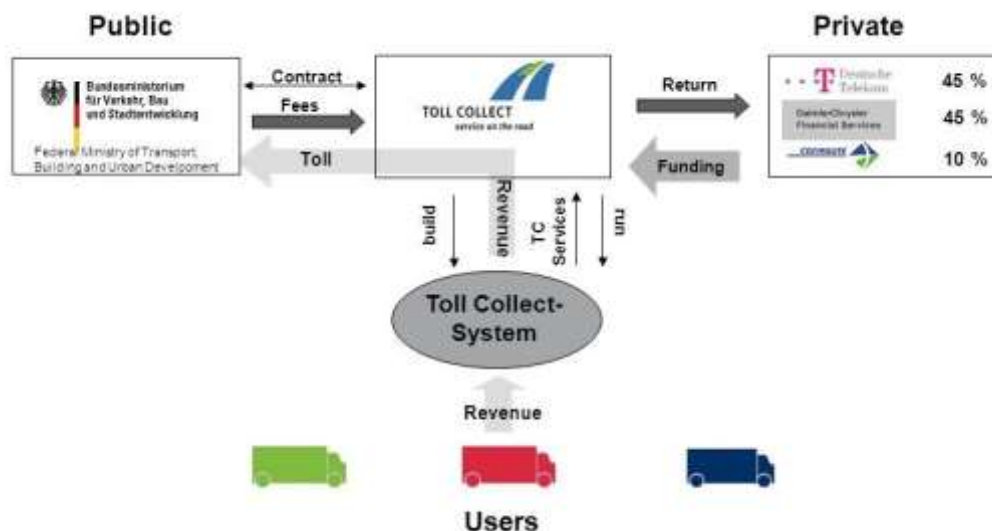


Figure 9 Structure model of Toll Collect (adapted from Broaddus & Gertz, 2008)

The German HGV toll system⁴⁴ works via a combination of satellite - and mobile communications technologies (see Figure 10).

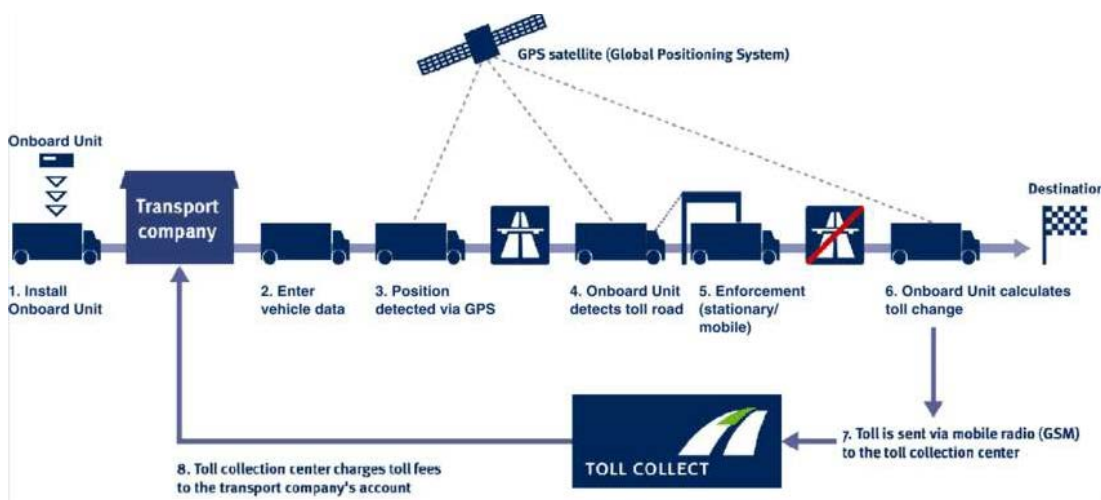


Figure 10 German HGV toll system (adapted from Broaddus & Gertz, 2008)

Most transportation companies must equip all their HGVs with so called “Onboard Units (OBUs)”. These OBUs automatically log-in into the toll system when there are using the toll roads. The GPS signal locates the vehicles, to draw a digital route of the vehicle’s journey. The radio communication service is calculating then the overall distance of HGV, sending it to the system which invoices the responsible hauler

⁴⁴ Other European toll models are presented in Appendix 3

(Broaddus & Gertz, 2008). This kind of toll collection was in favour of the government because it was fair to those users without OBU and only targets the HGVs.

5.2.3 Planning & introduction of Toll Collect

Since the 1970s, the German government planned to introduce a toll system, because of the growing traffic and rising infrastructure costs. This system oriented on the swiss model, paying a fee for the usage of the motorways. 1995 the government implemented the so called “LKW-Vignette”, a license for driving HGVs on the motorways (Bedszent, 2018). The only difference between the German model and the Swiss model was that in the German system the vignette was only for the German highways “Autobahns”, in Switzerland the haulers need the permission for every road type (see Appendix 3). After the introduction of the German vignette, the haulers simply used the country roads to avoid the payment. Another solution for the toll problem was needed, therefore the government started to plan 1998 a public-private partnership.

As a first step, the federal government started a bidding contest in 1999 for possible partners for the project. The requirements for being part of the PPP were knowledge in the field of tolls, experience in that sector and technological know-how. After a long selection process, the contract was signed in 2002 between the state and the private consortium of three companies⁴⁵ to create a joint venture, Toll Collect GmbH (Bedszent, 2018). Note here that the contract of the project was under strictly concealment and not even parliament members have the right to look at the contract. The design and creation of the contract already generated costs of around 16 million euros for private consultant companies⁴⁶. (Bedszent⁴⁷, 2018) The start of the project was schedule two months after the signature of the contract, but it delayed around three years.

⁴⁵ Listed in subchapter 5.2.2

⁴⁶ These problems are important factors for the upcoming chapter “Discussion”

⁴⁷ Unfortunately, there is not an equally good report about Toll Collect in English.

The delay was caused by several lawsuits against rival consortiums in front of the European Court and the technical issues with several functions of the system. The rival consortiums sued against the choice in favour of Toll Collect because they suspected that the election was already made before the application period (Bedszent, 2018). This suspicion was grounded on two key facts about the partners. The stock price of Deutsche Telekom AG was falling during that time and as their biggest shareholder, the federal government tried to help them (Bedszent, 2018). Also, the project partners hoped that their satellite- based toll system could be in charge of a future “EU-toll”, so the success of Toll Collect was a short-term and a long-term strategy in favour of the participants (Bedszent, 2018). The final start of the project was in the year 2005 (Broaddus & Gertz, 2008).

Another cause for the delay was the technical issues during the implementation which led to losses for the state. It took 16 months to run the toll system, even then it was not 100 percent operational. Due to the delay, the state lost 100 million euro per month in toll income (Edelhoff et al, 2018). Also, private consortium had to reinvest around one billion euro for the final functionality of the system. Consequently, the government cancelled the current contract and sued Toll Collect for compensation. The total loss for the public was, according the state administration, around nine billion euros (Edelhoff et al, 2018). The lawsuit landed in front of a private arbitration court (Bedszent, 2018). This legal confrontation between the two parties costs the federal government around 250 million euros for attorneys (Edelhoff et al, 2018). This court estimated the real compensation sum much lower than the state’s calculation of the damages. The final judgement in this lawsuit was in 2018 and it led to the settlement payment of 3,2 billion euros for the state. According to sources, only 1,1 billion euro is going to be paid to the public, the rest of the sum should be offset over the next couple of years (Edelhoff et al, 2018).

5.3 Performance evaluation

5.3.1 Abilities of Parties

One criterion for the abilities of the parties is that their proficiency matches the purpose of the project. On the public sector side is the German department of traffic and infrastructure, which is traditionally responsible for the motorways. The private sector needs to close the gap of the state in efficiency and practice experience. The private partners of Toll Collect are chosen by the industrial sector there are operating. Telekom Deutschland AG for the communication and technology, Daimler Financial Services AG for any kind of financial service of vehicles and Cofiroute for consulting and construction for the toll system. All those proficiencies combined cause a positive effect on the project. Now taking in account Campos' stand in which constructs are more significant for the project's success, "*abilities of parties*" is rank 2 of the four. For Toll Collect, the abilities of the participants didn't work out in the starting period. The delay was caused by the technical problems on the side of the private sector. That means already at the start the PPP was not fully functioning. This problem started a discussion between two sectors about responsibility, leadership and internal communication, also it raised doubt about the promised delivery of efficient skills of each party.

5.3.2 The Project's quality

Campos stated in his article that the "project's quality" have no significant effect on performance. The project "Toll Collect" is, after handling all starting problems running, delivering the planned output. Giving compliance- and discourse guidelines with the authorities helps the project company to construct a certain quality of the services.

5.3.3 The macroenvironment

The macroenvironment of the industry, Toll Collect is operating, is suitable for such a project. For Campos' model, the macroenvironment is still significant, because a project cannot positively perform if it is not in the right setting (Campos, 2018). Germany is with its infrastructure, traffic, geological location and economic power an appropriate place for Toll Collect. The economic relevance is given, with it also the political support by the government in reducing regulation in that field.

5.3.4 The microenvironment

The microenvironment within a PPP is the most significant “construct” for the success of the PPP, according to Campos. Especially, the factors of “appropriate risk allocation and sharing” and “strong private consortium” are the most discussed ones (Campos, 2018). The first factor of “appropriate risk allocation and sharing” is usually arranged in the contract, which represents the foundation of the business environment with the responsibilities of the participants. In the case of Toll Collect, the current regulation is concealed, so there is no real knowledge of how the risks of the project are shared between the parties.

The factor of “strong private consortium” is also present in Toll Collect. Two of the three private companies in the consortium playing a major role in the German economy. Every company is specialised in their own industry and bring the needed expertise and capital into the project to make its operation successful. The consortium is funding the project with expectation of growing returns at the end of a business year. To get the higher gains from the project, the consortium tries to increase its influence on the PPP's business strategy. This behaviour lead to internal disputes which is one of the main reasons, why Toll Collect is nationalized today⁴⁸.

⁴⁸ More to this fact in subchapter 5.4

5.3.5 PPP Performance

The last construct of Campos' model summarizes the other constructs and measures the total gains of the PPP, which gives a picture of the project's overall performance.

The total financial gains of Toll Collect are high, estimating around 4-5 billion euros in return every year between 2009 and 2018 (see Figure 12).

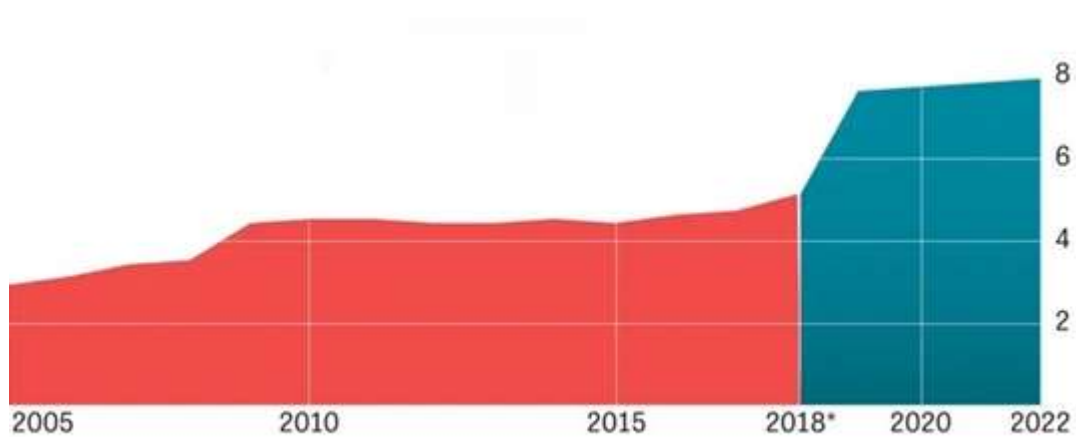


Figure 11 Total incomes of the HGV Toll from 2005 till 2022, from 2018 till 2022 the blue field shows the prognosed income (adapted from Edelhof et al, 2018)

Figure 13 shows that the overall performance, after the delay, generates high incomes for the state and the private sector. There is no open information about the operational and bureaucratic gains of the project are no open information available but based on the income development of the toll system, they should be positive. There were no competitive gains, because Toll Collect has a monopoly on the toll system on German motorways.

5.4 Current Status

As mentioned, the present's status of Toll Collect is that the PPP is nationalized since 2018. In Figure 13 shows a projected income from 2018 to 2022 due the nationalization and the separation from the private sector. The reasons for the nationalization of Toll Collect was the ongoing scandals, organizational failures and the growing transaction costs around the PPP.

The key moment for nationalization is the most recent scandal in 2017, where some high-ranked employees of Toll Collect were suspected of fraud. According to the responsible officials and police, Toll Collect invoiced over year irregular high costs to the state, including high success- and risk premiums plus contractual guaranteed dividends. Also included in the costs were expenditures which had nothing to do with business of Toll Collect, like an old-timer race event or private trips of managers (Edelhoff et al, 2018). The total sum of those fraudulent invoices is estimated to around 300 million euros (Edelhoff et al, 2018). Edelhoff et al. (2018) describes this situation in his article for the German newspaper DIE ZEIT as “*a contract with nearly risk-free profits for a private company, backed up by the state*”. Edelhoff guesses the motive behind such a behaviour was that the private companies wanted to retrieve the investments, which they paid beginning of the project regardless of the means. Additionally, the state knew about the fraudulent behaviour of the management members, but responsible state representative decided not to act against it, because of fear that this affair would ruin the image of the PPP (Edelhoff et al, 2018).

Another problem arises in 2018, which will cost the government a high amount of state capital, namely the lawsuits of different transport companies against the HGV toll. For the haulers, the current price level of the toll is too high, so they entered an objection against it. A court granted the objection, so the current reclamations for the haulers accumulates close to 1,75 billion euros (Bedszent, 2018).

After all these revelations, the government decided to let the contract with the private sector expire, making Toll Collect a public company in 2018 (Bedszent, 2018). Nevertheless, the former and current German ministers for infrastructure and traffic⁴⁹ had the opportunity to nationalize the PPP earlier in 2015, but they were convinced about the concept and success of Toll Collect, which led to an extension of contract for three more years. After the extension period, they started to look for new private partners for the project, which was a questionable decision, leading to extensive criticism from the public. In addition to the new selection of new partners, they both planned to put Toll Collect in charge of an upcoming car toll. This plan was stopped by the European high court because the car toll would have discriminated other car drivers from EU member states⁵⁰ (Posauner, 2019).

⁴⁹ Alexander Dobrindt and Andreas Scheuer

⁵⁰ In the author's opinion, this topic is good example for political mismanagement

6. WHY DO PPPS FAIL? – A DISCUSSION

This chapter discusses the question “why do PPPs fail?”. This chapter reviews the previous two chapters and evaluates the reasons for the malfunctions. For this discussion, the chapter states that a PPP fails when it reaches one of the three following stages: First, the PPP becomes a public company after the contractual time period. Second, the operation produced exceptional high costs during its operation period. Third, the grade of negative political and public reputation of the PPP, including the intensity of critics and reasonable displeasure towards a certain PPP. For a better oversight, this chapter structures the main discussion points in four segments.

First, PPPs fail because of internal problems rather than external problems. There is no specific evidence of how the external environment⁵¹ has a negative effect on PPPs. Proof of this statement is Campos’ conclusion that the macro environment is the least influential factor for the project performance⁵². The environment takes care of the legislation and the maintenance of that sector where the PPP is interacting. As described in the case study and in the theory part, the success of a PPP depends on the business decisions of its internal management, its structure of finance and on the relationship between the project partners. The case study and the microeconomic theory shows that conflicts of interest, contractual issues and legal disputes can have an outburst of transaction costs and contribute or even lead to external problems, in case of the case study to a lack of investment in infrastructure.

Second, the analysis of PPP-performance is only based on hard data. “*Hard data*” is a very unreliable source of information, it provides non-detailed outcomes of internal processes. Such superficial data covers up errors and malfunctions, which leads to a misconception about the PPP. It is also obstructive for the truthful measurement of a project performance. Late exposure of the relevant detailed information affects negatively the image of the PPP, loses the trust of the stakeholders and future investors. In the case study, the PPP gained a damaging reputation and diminishing support from the public because of the secretive handling of data collection, contract details, the

⁵¹ For this case, it is the state or the public

⁵² See Chapter 2.4

unknown financial structure and lawsuits in front of a private court. All those factors played a part in the failing of the case company Toll Collect. The limited access to the relevant information is a threat to the PPP-success.

Thirdly, planning mistakes are made on the microeconomic level, not on the macroeconomic level. For this segment, the theory part plays the leading role. Arguments for PPPs on a macroeconomic theoretical level are based on simple assumptions and hard data, which, as described in segment two, is misleading. Macroeconomic theory just assumes that more capital and more labour through PPPs leads to economic growth, without taking the moral hazards within the project into account. The microeconomic theory takes the mistakes and hazardous situations within a PPP into consideration. The researches implicate, that prioritising only macroeconomic objectives in the planning period, without bearing the superior interests of the potential private partners in mind, the responsible public contractors are facing the mentioned problems in the short- and long run. The microeconomic research outcomes which are related to PPPs are clear indicators for possible default of a PPP. All articles consulted for this thesis confirm this probability. This theoretical approach and its research findings on PPPs need to be a more influential input in the planning process and in political discussions. The optimization problems in chapter 4.1 and the game theory in chapter 4.2 reveal the possible complications which occur within a PPP and within the interaction between parties. Keeping these scientific findings in mind, future PPPs would have a diminishing rate of failures in contrast to their counterparts from the past and could save the public high sums of capital.

Fourthly, a major reason why PPPs fail is human misbehaviour. Throughout the research, human characteristics like greed, self-interest, opportunism are outstanding traits connected to PPP-failure. Any promising PPP-project can fail if there is human mismanagement. Ping Ho (2013) took some of those characteristics in account in his research and proved their importance in his research result. Also the case study verifies, that some of the events which lead to nationalization of Toll Collect are based on human misbehaviour, for example the extra cost for private pleasures and the high invoices. A lot of the decisions about the PPP are irrational rather than rational. The responsible political bodies knew from the fraudulent behaviour of the managers, but did not move against it because of fear for the image of the project. The sources of such misbehaviour⁵³ are versatile

⁵³ culture, family, training etc.

7. SOLUTIONS FOR PREVENTING PPP-FAILURES

This chapter proposes solutions for preventing a possible PPP-failure. These solutions are based on the economic theory, literature reviews and the case study for this thesis. One solution is the introduction of an optimized governance structure with a clear hierarchy. Such a structure can handle internal problems in a more efficient way and monitors the business process on a managerial level. The supervising boards are occupied by representatives of the state and private partners, to ensure each party's interest. Additionally, a third party audits the actions of the boards independently and support business decisions. This party can be rather publically and privately, bounded on some regulations⁵⁴, to guarantee its independency.

Another solution is CSR-standards for PPP on a nation-wide level. Corporate social responsibility combines economic, social⁵⁵ and environmental goals into one framework. This framework transformed into legal standards for the selection process, is useful for the state and potential partners. Investors can measure their possible gains from this project and therefore have security in planning long-term strategies. The state protects itself from uncertainties and moral hazards. Those standards keep away hazardous interest groups by putting the goals as a minimum requirement for a partnership and legal bottom lines. A CSR framework should provide the public and population insight of on which criteria a PPP delivers the service. By doing so, a PPP find the necessary support and understanding from its users about its right to exist.

The last solution would be bringing more attention on the present findings of scientists. Economists like Ping Ho, Lavliinski, Hoppe, Hodge giving policy makers detailed information about the different factors which should be part of the planning process. PPPs nowadays merely rely on the promises of the project partners to increase economic growth. They do not take microeconomic concerns in account and so they face the already mentioned issues.

⁵⁴ Is not allowed to hold shares etc.

⁵⁵ higher transparency etc.

8. SOME OTHER ISSUES OF PPPS

8.1 Conflict of interest

In planning and leading of a PPP lies a high potential of conflict between the different interests of each faction. The goal of the participants is the growth their net present value of their share of the PPP. Chapter 4 represents this conflict of interest on a theoretical, analytical way. Lavliinski (2016) and, especially, Ping Ho (2013) confirm in their works the existence of such conflicts between the partners and the negative effects the conflicts can cause. Within a PPP, the views of the players on how the PPP is to be managed can vary from player to player, meaning a diverse opinion on long-term strategies and leadership. In addition to this, the different characteristics of the players are also able to damage their relationship, characteristics like opportunism, competitive behaviour, etc., which can lead to diverse hazards (Estache & Saussier, 2014) and unwanted high transaction costs (Ping Ho, 2013).

Both researches state the two different objectives of maximization. The state/population wants to increase their welfare, the investor wants to increase his profits. It will be even more drastic, when the investor has to fulfil shareholder expectations, who aims to increase value⁵⁶. Within those two different goals rests a kind of moral dilemma, which both players are involved in.

To forecast possible conflicts based on a non-theoretical way, Campos' critical success factors are useful. They show, based on empirical data and surveys, that for private entrepreneurs it is important to play a leading role in a PPP, to cover their interest. This claim can be seen in the CSF's "strong consortium" and "appropriate risk allocation and sharing" (Campos, 2018). There, the entrepreneur chooses factors to undermine their interest to gain a leading position with the chance of risk sharing. Therefore, the more the risk is shared between partners, the more interesting is the project for the private sector.

⁵⁶ This thesis doesn't go deeper into the relationship between investor and shareholder within a PPP. In present-day economy it is fair to mention that the growth of shareholder value plays a role in companies who are listed at the stock market.

In the case of Toll Collect, the conflict caused high costs. The partners tried to settle their internal disputes, whose origins were the ongoing scandals and malfunctioning system, in front of a private court. A fact that shows how impossible it was to solve these problems in a “normal” managerial way. Reasons for this could be the contractual agreements or planning mistakes in the beginning.

8.2 Transparency issue

Transparency is an important trait in the interaction between two individuals. It exposes motives, ideas, interests and other important information for and about your counterpart. The more transparent and “honest” or “less secretive” people are to each other, the easier it is for both parties to build up a trustful relationship⁵⁷. It is basically the same as the relationship between seller and buyer. When the seller is trustworthy and open, the buyer will return frequently. In return, a non-transparent interaction causes the opposite reaction. Non-transparency can cause difficulties in transferring a positive image or raise support for the project. A good example for non-transparency is Volkswagen’s behaviour during the diesel scandal (Lee, 2018). Therefore, to run a publically accepted PPP, it is vital to inform the user of the service and be transparent to the stakeholders.

During the research for the case study, it was surprising to note how little the public knows about contractual details of the PPP “Toll Collect GmbH”. Even elected representatives have no full access to the contract. It is one part of a series of lacking transparency within PPPs, especially about the PPP in the case study (Bedszent, 2018). The transparency issue about the contract, which has around seventeen thousand pages on the responsibilities of the contract partners and is under absolutely concealment⁵⁸, is not the only non-transparent fact which matters in this PPP. Also unknown are the methods of measurement about how successful all the processes are running and the amount of capital the project company gets from the overall toll revenue. Every detail about business procedures and capital flows within the PPP between the contract

⁵⁷ For example marriages, friendship etc.

⁵⁸ Parts of the contract were published via Wikileaks. The author will not use this reference because of legal concerns

partners are not being published from the government, which makes it hard to get a final evaluation about the performance and accomplishments of the PPP (Bedszent, 2018). The government and his private partners tried to keep any critical voices away from the PPP. Most of the arguments they made for the PPP are based on the hard data about the yearly revenue. When more and more newspaper started to report about the PPP and its non-transparency, the public started to question why important documents are under such a strict concealment. Till today none of the questions can be answered concretely.

Another fact to mention correlated with that issue are the secret lawsuits in front of private courts. The settlements of the problems mentioned in subchapters 5.2.3 and 5.4 are based in the judgement from a non-elected, private judge outside of the democratic system. This raises not only ethical and moral reservations, also it raises the question of whether a private judge could be biased in the moment of the ruling (Bedszent, 2018).

8.3 Monitoring issue

Monitoring performance is a key aspect in running a common project. Proper monitoring provides necessary data and information about the current status and progress of a project. Pursued in the right way, it saves time, labour and financial resources in every single sector. But it is not necessarily self-explanatory that every project has the right monitoring procedures to detect internal errors.

In case of PPPs, the issue with monitoring is substance of discussions. Too much monitoring and interferences can endanger the success, too little monitoring can discover internal transgressions too late. Another part of the discussion is who is responsible for the monitoring. If it is assigned to the public sector, a possible outcome of it could be that the project is getting overregulated⁵⁹. When the private sector monitors the project, it would try to lower costs and expenditures of the project in favour to increase their profit share, then the service quality could suffer⁶⁰.

⁵⁹ An example is the "crowding-out-effect"

⁶⁰ In education, health care

A third possibility is that the project company itself monitors it. For “Toll Collect”, this kind of monitoring caused costs for the public sector. First, because of the delay, the state needed to save investments for infrastructure, which summed up to billions of euros, which were missing at the time of demand. Second, the management invoiced private expenditures to the state, so in fact to the taxpayer. This behaviour led to the lawsuit against Toll Collect because of fraud. The state did not monitor performance and financial flows, so the state kept paying for subjects, which had nothing to do with the company and the service⁶¹. If the state had monitored the business processes much earlier, they would have noticed the invoice fraud and reacted against it. So in the end, the taxpayer bears the costs for the mismanagement and the lack of proper monitoring, which could prevent this circumstance.

8.4 Cost of errors

The “Cost of Errors⁶²” can be defined as follows: “*The cost of errors are the accumulation of all losses, triggered by the malfunction of a project, which are hard to measure in the short run or not suitable to determine a numerical value*”. This kind of costs includes opportunity costs, political reputation losses, welfare losses, efficiency losses and the losses based on negative externalities⁶³, especially on the environment. These losses are hard to measure and their effects appear in the future. Especially in case of a failing PPP, which covers a particular public good/service and have an effect on the life of the population, it is difficult for policy maker and researcher to value these losses numerically, which could help to estimate the complete extent of a project failure. The cost of errors is a bias which policy maker should remember to protect the public from the possible negative outcome of the PPP.

⁶¹ Even when the state knew about the fraud, the author assumes for the chapter, the state did not know

⁶² The author couldn’t find a suitable term which characterizes such costs/losses. Therefore, the author decided to create his own definition of such an circumstance. Please note that this is the author own creation, it is not a common, certified explanation.

⁶³ Negative externalities are negative effects on a third, not-participating person. Like lung cancer because of car traffic etc.

A good example of this cost concept is found in the case study. During the operation of Toll Collect, these costs were accumulating steadily. The full cost of this project costs to the public is not measurable. How much influence the CoE's have on the political career of the responsible persons, how much welfare the public lost because of the failure and how much capital will be needed to compensate the negative externalities the PPP caused, all of these question can be only measured over long time period and cannot be answered in the short-run.

8.5 Economic relevance & the lack of empirical evidence

Throughout the literature review, the findings about the economic relevance of PPP are mixed. In their article, Fabre & Straub (2019) state that PPPs can have some efficiency gains, but they can't prove that PPPs are, in their current form, the best solution. They researched different public sectors about the performance of PPPs, they found that PPPs have some influence, but they carry other problems in design and scale.

Kwame Sundaram's work from 2016 expresses that PPPs even turn out to be more expensive than the actual traditional procurement, because they can't deliver the promised increase in service quality, including efficiency, development and coverage (Kwame Sundaram, 2016). The impact of PPPs highly depends on the sector, macro environment and the general lack of capital in specific regions.

Hoppe (2013) formed in his article an experimental approach, to prove which procurement has the higher trade-off. In the experiments, Hoppe (2013) found that PPPs have higher incentives to invest in cost reduction but only if the investments are used to enhance quality (Hoppe, 2013). Under the assumption that PPPs are making the desirable investments, PPPs are preferable (Hoppe, 2013). The experimental approach of Hoppe (2013) assumes that PPPs always chooses quality-enhancing option. Finally, Hoppe also states that investment can have positive and negative effects on quality, based on the forms of investments.

There are many different approaches of many researches who are trying to solve the question about the relevance and importance of PPP-model for an economy and a state. Because of the mixed outcome, the different methods and diverse mathematical formulations in those researches, there is no final evidence for the claim that PPPs are superior to traditional procurement.

9. CONCLUSION

Finally, it is fair to say that in PPPs and in their advantages lie a great chance to replace the traditional public procurement, even there might not clear scientific proof for this idea (Kwame Sundaram, 2016). Nevertheless, these advantages signify a higher utility for a state by combining the professional expertise of public and private sector. This relationship is able to increase the efficiency and quality of public goods and services, boost employment and gain access to new sources of capital. These benefits of PPPs are mentioned correspondingly in the literature about PPPs and by the supporters. PPPs clearly play a major role in policy decisions of today and in the future. Overall, there is a positive image of PPPs in literature and about their contribution to economic growth according to the Solow-Model, analysed in chapter three.

Despite the good theoretical approach of PPPs, many projects are failing over time. The reasons for the failure rates are based on managerial decisions and microeconomic errors during the implementation - and operation period of the project. Considering the microeconomic approach on PPP-failure, Lavliński (2016) and Ping Ho (2013) pointing out especially the high potential of interest conflict between the partners. A good example of the conflict between partners is described in the case study. These internal problems lead to a high rate of malfunctions among such projects like Toll Collect. The opportunism of groups and single persons influences the management decision and effects so the overall PPP-performance. The scientific literature and the case study deliver evidences to this statement.

As a conclusion, it is obvious that project partners or states need to take problems and issues with PPPs in stronger consideration in order to start a successful long-run project. A failing PPP has incalculable effects on the population⁶⁴, because citizens depend on certain public goods and services. Therefore, actions are needed, to diminish the chance of human mismanagement and opportunistic behaviour. Ping Ho (2013) suggests two methods: a clear framework of the project and the selection of long-term profit-oriented partners. Other methods would be a better governance structure and higher standards in CSR-practices.

⁶⁴ As can be seen in the case study

Further research in PPPs offers a variety of relevant topics, especially in the context of the economic relationship of public and private sector of today and in the future. But this research is only possible, if the researcher has full access to all information and data of a PPP during and after the PPP's operations. This way, the researcher can guarantee an accurate research result and can terminate unknown values. For this chapter, the author proposes several future research subjects for PPPs.

To determine which procurement form for a public good is now more favourable for all, a direct comparison between a PPP-company and its public equivalent is needed to answer this question. Tested under equal conditions, the findings can give more precise data about which form performed better. Such a comparison might be difficult to realise, because of the many factors and requirements, researchers have to respect in order to achieve a perfect outcome.

Another subject is the influence of shareholder value and shareholder expectations on the overall PPP-management. In present-day economies, shareholder value plays a vital role in the strategic making of stock companies. It would be interesting to know, if PPPs who are linked to the stock market⁶⁵ perform better or worse than non-linked companies.

A research subject based on the human behaviour within a PPP. As mentioned in chapter six, human misbehaviour leads to a potential PPP-failure. The revelation of the motivations, reasons and psychological preconditions which leads to fraudulent behaviour within PPPs might be helpful for choosing future manager and trustful employees.

A final recommendation is research on how much the economic and cultural mind-set contributes to the decision to create a PPP. Throughout the research about the selection process, it becomes clear that there exist more irrational arguments for PPPs than rational. This means, that decision makers could be aware of the disadvantages of some specific PPPs but still support the idea. Therefore, a possible topic is to find out which specific⁶⁶ mind-set may support PPPs more and which mind-set supports it less. This research could also be a part of the previous research proposal about human behaviour.

⁶⁵ by companies, investors, promoters etc.

⁶⁶ cultural, economic, personal, social

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APPENDICES

Appendix 1

Infrastructure Contract Nomenclature

Contract Nomenclature	Overview Description and Reference	Type of Asset	Functions Transferred	Payment Source
Design-Build-Finance-Operate-Maintain (DBFOM); Design-Build-Finance-Operate (DBFO); Design-Construct-Manage-Finance (DCMF)	Under this nomenclature, the range of PPP contract types is described by the functions transferred to the private sector. The <i>maintain</i> function may be left out of the description (so instead of DBFOM, a contract transferring all those functions may simply be described as DBFO, with responsibility for maintenance implied as part of operations). An alternative description along similar lines is Design-Construct-Manage-Finance (DCMF), which is equivalent to a DBFOM contract.	New infrastructure	As captured by contract name	Can be either government or user pays
Build-Operate-Transfer (BOT), Build-Own-Operate-Transfer (BOOT), Build-Transfer-Operate (BTO)	This approach to describing PPPs for new assets captures legal ownership and control of the project assets. Under a BOT project, the private company owns the project assets until they are transferred at the end of the contract. BOOT is often used interchangeably with BOT, as Yescombe (Yescombe 2007) describes. In contrast, a Build-Transfer-Operate (BTO) contract, asset ownership is transferred once construction is complete. As Delmon (Delmon 2015, 20–21) describes, ownership rights mainly affect how handover of assets is managed at the end of the contract.	New infrastructure	Typically, design, build, finance, maintain, and some or all operations Under some definitions, BOT or BTO may not include private finance, whereas BOOT always includes private finance	Can be either government or user pays

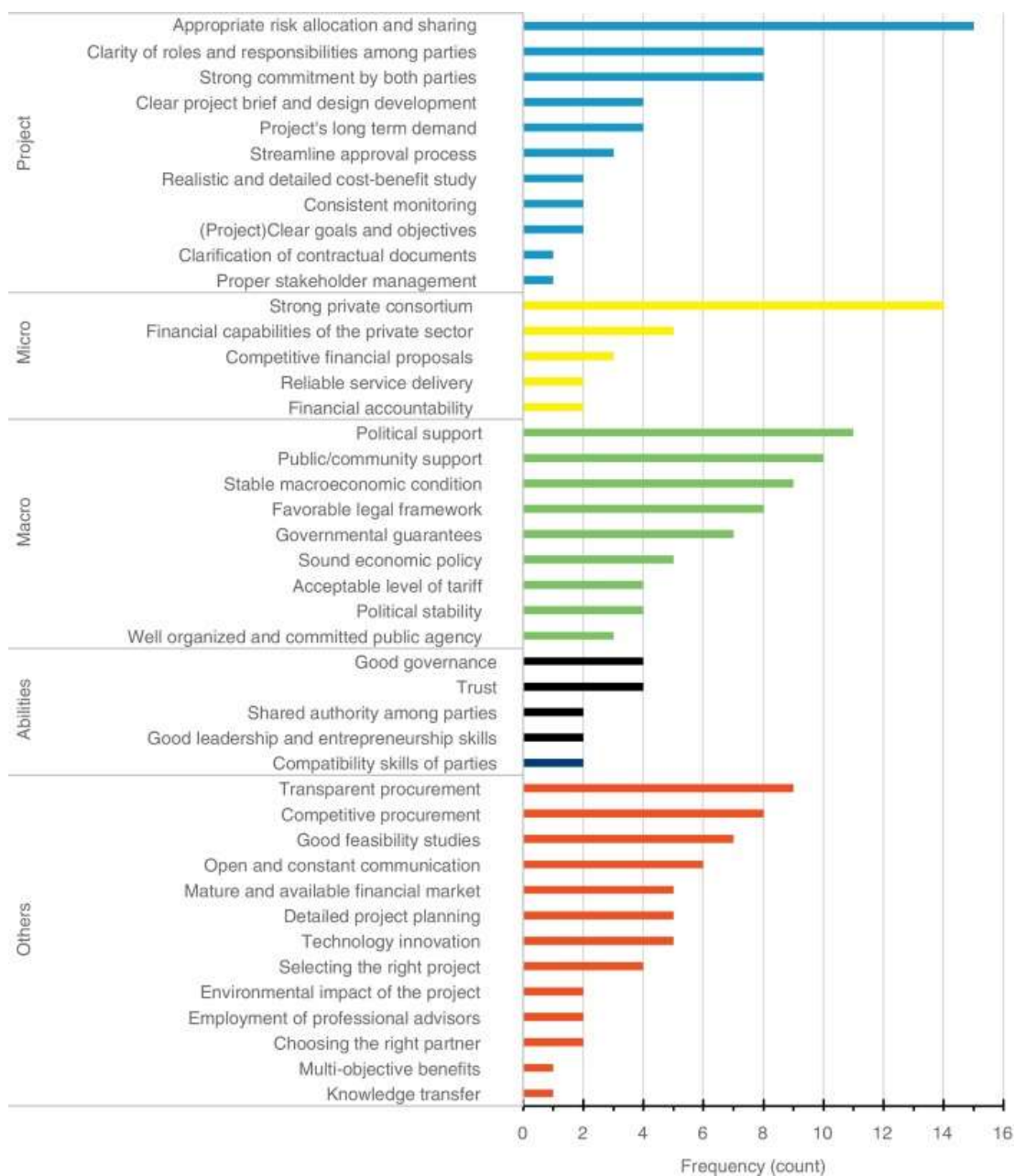
Rehabilitate- Operate- Transfer (ROT)	In either of the naming conventions described above, Rehabilitate may take the place of Build where the private party is responsible for rehabilitating, upgrading, or extending existing assets.	Existing infrastructure	As above, but rehabilitate instead of build	As above
Concession	Concession is used for a range of types of contract, as described in Delmon (Delmon 2010, Box 1 on page 9). In some jurisdictions, concession may imply a specific type of contract; while in others it is used more widely. In the PPP context, a concession is mostly used to describe a user-pays PPP. For example, in Brazil, the Concession Law applies only to user-pays contracts; a distinct PPP Law regulates contracts that require some payment from government. On the other hand, concession is sometimes used as a catch-all term to describe a wide range of PPP types—for example, all recent PPPs in Chile have been implemented under the Concession Law, including fully government-pays contracts.	New or existing infrastructure	Design, rehabilitate, extend or build, finance, maintain, and operate—typically providing services to users	Usually user pays—in some countries, depending on the financial viability of the concession, the private party might pay a fee to government or might receive a subsidy
Private Finance Initiative (PFI)	The United Kingdom was one of the first countries to introduce the PPP concept under the term Private Finance Initiative , or PFI . It is typically used to describe a PPP as a way to finance, build and manage new infrastructure.	New infrastructure	Design, build, finance, maintain—may include some operations, but often not providing services directly to users	Government pays
Operations and Maintenance (O&M)	O&M contracts for existing assets may come under the definition of PPP where these are performance-based, long-term, and involve significant private investment (sometimes also called performance-based maintenance contracts).	Existing infrastructure	Operations and maintenance	Government pays

Affermage	An <i>affermage</i> contract is similar to a concession, but with the government typically remaining responsible for capital expenditures. <i>Affermage</i> in particular may have a specific meaning in some jurisdictions. The World Bank's explanatory notes on water regulation (<u>Groom et al. 2006</u> , 36–42) describe lease contracts, as well as concessions. Such contracts may or may not come under the definition of PPP, depending on the duration of the contract.	Existing	Maintain and operate, providing services to users	User pays—private party typically remits part of user fees to government to cover capital expenditures
Management Contract	The state retains asset ownership, and capital expenditure is the responsibility of the public sector, whereas operation and maintenance is the handled by the private sector. These types of contracts are 3-5 years in duration.	Existing	Operations and maintenance	Management fees extended to the contractor
Franchise	<i>Franchise</i> is sometimes used to describe an arrangement similar to either a concession or a lease or affermage contract, as described in Yescombe (<u>Yescombe 2007</u>).	Existing or new	May include design, build, and finance, or may be limited to maintaining and operating an asset	User or government pays

(Source: World Bank, 2017)

Appendix 2

Critical Success Factors for PPPs



(Source: Campos, 2018)

Appendix 3

Types of HGV tolling systems in Europe

TABLE 1 Types of HGV Tolling Systems in Europe (2)

	Per Day Fee—Vignette	Per Segment Fee—Toll Plazas	Per Kilometer Fee—Free Flow
Payment	All vehicles purchase a permit sticker (vignette), attached to windshield, sold by 24 h, week, month, year	All vehicles using roadway pay at junction toll plazas, HGVs can use toll badges for electronic billing	HGVs pay for each kilometer traveled using onboard units with chip cards registered to specific vehicles for electronic billing
Technology	Windscreen sticker	Technology: DSRC ^a	Technology: DSRC, GPS, GSM ^b
Financing	Public	Financing: public and private	Financing: public and private
Operator	Public	Operator: public or concessionaire	Operator: concessionaire
Use	Revenues used for highway construction, maintenance, and operations	Revenues used for highway and rail construction, maintenance, and operations	Revenues used for transportation infrastructure
Countries	Belgium, Bulgaria, Denmark, Hungary, Lithuania, Luxembourg, Netherlands, Poland, Romania, Slovakia, Sweden, Turkey	Czech Republic, France, Greece, Italy, Portugal, Slovenia, Spain, England	Austria, Germany (autobahns) Switzerland (all roads)

^aDSRC = dedicated short-range communication.

^bGSM = Global System for Mobile Communications.

(Source: Broaddus & Gertz, 2008)